City of Santa Clara
Building Inspection Division

1500 Warburton Avenue
Santa Clara, CA 95050
Phone: (408) 615-2440
Fax: (408) 241-3823
http://www.ci.santa-clara.ca.us

ELECTRICAL REQUIREMENTS

October 15, 2004

2.6.6 Pilot Lights Prohibited

This mandatory measure applies to HVAC equipment as well.

§115

Natural Gas Central Furnaces, Cooking Equipment, and Pool and Spa Heaters: Pilot Lights Prohibited.

Any natural gas system or equipment listed below may be installed only if it does not have a continuously burning pilot light:

(a) Fan type central furnaces.

(b) Household cooking appliances.

EXCEPTION to Section 115(b): Household cooking appliances without an electrical supply voltage connection and in which each pilot consumes less than 150 Btu/hr.

(c) Pool heaters.

(d) Spa heaters.

Any of the following natural gas systems or equipment may be installed only if it does *not* have a continuously burning pilot light:

- Fan type central furnaces
- Household cooking appliances, except cook-ing appliances without an electrical supply voltage connection and in which each pilot consumes less than 150 Btu/hr
- Pool heaters
- Spa heaters
- Fireplace*
- Decorative gas appliance*
- Gas log*

*§150(e) specifies that a fireplace, decorative gas appliance, or gas log cannot have a continuously burning pilot light.

The following natural gas appliances cannot have a standing or continuously burning pilot light:

- Fan type central furnaces
- Household cooking appliances, except cook-ing appliances without an electrical supply voltage connection and in which each pilot consumes less than 150 Btu/hr
- Pool heaters
- Spa heaters
- Fireplace
- Decorative gas appliance
- Gas log

Example 2-7 – Continuously Burning Pilot Light

Question

Under what circumstances is a constantly (or continuously) burning pilot light prohibited on certain appliances?

Answer

For compliance with the *Standards*, §115 prohibits continuously burning pilot lights for some natural gas burning equipment (this does not include liquefied petroleum gas burning appliances). §115 prohibits continuous pilots on the following types of equipment:

- Household cooking appliances with an electrical supply voltage connection in which each pilot consumes 150 Btu/hr or more
- Pool heaters
- Spa heaters
- Fan type central furnaces

§150 (e) prohibits continuously burning pilot lights for:

- Fireplaces
- Decorative gas appliances
- Gas logs

For compliance with federal and state appliance regulations (which apply to any appliance sold or offered for sale in California), a constant burning pilot light is prohibited on:

- Gas kitchen ranges and ovens with an electric supply cord
- Pool heaters, except those that burn liquefied petroleum gas

2.7 Lighting

The *Standards* have mandatory measures that address:

- Kitchen Lighting
- Bathroom Lighting
- Recessed Lighting

2.7.1 Kitchen Lighting

§150 (k) 1, 3

1. *Luminaires for general lighting in kitchens shall have lamps with an efficacy of not less than 40 lumens per watt. General lighting must provide a sufficient light level for basic kitchen tasks and provide a uniform pattern of illumination. A luminaire(s) that is (are) the only lighting in a kitchen will be considered general lighting. General lighting shall be controlled by a switch on a readily accessible lighting control panel at an entrance to the kitchen.*

   Additional luminaires to be used only for specific decorative effects need not meet this requirement.

4. *Luminaires installed to meet the 40 lumens per watt requirements of Section 150(k) 1. or 2. shall not contain medium base incandescent lamp sockets, and shall be on separate switches from any incandescent lighting.*

Installing energy-efficient lamps and fixtures can reduce lighting energy costs without sacrificing the quality or quantity of light available. The intent of the kitchen lighting code is not to increase the number of light fixtures and/or watts used by the occupant but rather to ensure that the builder provides - and the occupant uses - energy efficient lighting. As indicated in Table 2-7, a 40-watt (Full-Size, 4' long) standard fluorescent lamp

is over four times as efficient (in terms of efficacy) as a 100-watt standard incandescent lamp ('efficacy' is defined in §101(b) of the *Standards* as, "…the ratio of light from a lamp to the electrical power consumed (including ballast losses) expressed in lumens per watt").

General lighting is the lighting that the occupant will typically use on a regular basis (normally fluorescent lighting, but may be other types with efficacy of 40 lumens per watt or greater). If there is only one light in the kitchen, it is general lighting. The International Society of Illuminating Engineers (IES) guidelines recommend that at least 30 footcandles of light be provided for visual tasks in kitchens. Visual tasks include, but are not limited to, basic kitchen tasks such as preparing meals and washing dishes. These tasks typically occur on accessible kitchen countertops, the tops of ranges and in sinks, where food preparation, recipe reading, cooking, cleaning and related meal preparation activities take place, as well as at the front of kitchen cabinets.

The general lighting in kitchens must:

- Have an efficacy of *at least 40 lumens/watt* (see Table 2-7).
- Provide a uniform pattern of lighting, such as a fixture in the center of the kitchen or around the perimeter (not a fixture in the corner).
- Provide a light level sufficient for performing basic kitchen tasks such as preparing meals and washing dishes.
- Be controlled on a readily accessible switch at an entrance to the kitchen (not in a cupboard or beside the kitchen sink).
- Be switched independent of incandescent lighting.
- Not contain medium-base incandescent lamp sockets. This prevents the occupant from replacing the efficient light source with an incandescent lamp.

Additional luminaires for decorative effect do not need to meet these requirements, however, incandescent lighting fixtures recessed into insulated ceilings must be approved for zero-clearance insulation cover (IC-rated) in compliance with §150(k)4 (see Recessed Lighting below).

To clearly demonstrate compliance with the *Standards* to a building department, a lighting layout design that includes a point-by-point illuminance grid for the high-efficacy lighting may be provided. To do this properly, this grid must account for the room geometry, fixture placement, photometric data for the fixtures, lamp lumens, lamp lumen depreciation, and reflectivity of all of the surfaces in the kitchen.

Table 2-7 – Typical Efficacy of Electric Lighting Sources

Light Source	Type	Rated Lamp (Watts)	Typical Efficacy (Lumens / Watt)[1]
Incandescent	Standard	40 - 100	14 - 18
Incandescent	Halogen	40 - 250	20[2]
Incandescent	Halogen IR	See footnote [3]	Up to 30
Fluorescent (Lamp/ Ballast Systems)[4]	Full-Size, 4' Long	32 - 40	69 - 91
	U-Shaped T-8 Bipin	16 - 31	78 - 90
	Compact Fluorescent	5 - 9	26 - 38
	Compact Fluorescent	13 +	42 - 58
Metal Halide	Metal Halide	32 - 175	50 - 90
High Pressure Sodium	White High Pressure Sodium	35 - 100	36 - 55

1 Includes power consumed by ballasts where applicable.

2 Halogen capsule incandescent lamps may be the most efficient light source for highlighting applications. Most halogen lamps are designed to produce a beam of directed light. Manufacturer's data typically list the "candlepower" intensity of that beam, rather than lumens (lumens measure total light output in all directions).

3 A new technology using infrared reflecting films on the halogen capsules has increased output up to 30 lumens/watt for some high wattage lamps.

4 Efficacy of fluorescent lighting varies depending on lamp and ballast types.

Example 2-8 – Energy-efficient Kitchen Lighting, General

Question

I want to design and provide an energy efficient kitchen. I especially want the lighting design to provide an aesthetically pleasing appearance, sufficient light for basic kitchen tasks, and be energy efficient while also complying with the Energy Efficiency Standards. What is the recommended practice for achieving this goal?

Answer

It is recommended that the builder use one of the following four ways to show compliance:

1. Design and install only high-efficacy luminaires in the kitchen. This scenario meets the code requirement in the most straightforward manner. When kitchen lighting includes both high-efficacy sources and low-efficacy sources, the design may not meet these requirements. The second through fourth ways of showing compliance apply to kitchens with both high- and low-efficacy sources.
2. Provide at least 1.2 Watts per square foot (total square feet of the accessible kitchen floor and countertop areas) of light from high-efficacy sources, and ensure that, in the judgment of the building department plan checker, the lamps in those fixtures produce a substantially uniform pattern of lighting on kitchen work surfaces (please note that this is not a code requirement but a recommendation).
3. Make sure that at least 50% of the kitchen lighting wattage is high-efficacy, and that, in the judgment of the building department plan checker, the lamps in those fixtures produce a substantially uniform pattern of lighting on kitchen work surfaces (please note that this is not a code requirement but a recommendation).
4. If you wish to be certain you have provided an “energy efficient kitchen…an aesthetically pleasing appearance…sufficient light for basic kitchen tasks…while also complying with the Energy Efficiency Standards,” it is recommended that you use the same procedures used by professional lighting designers (again, the intent of this recommendation is not that these procedures become a standard part of builder submittals, but rather that they are used to provide the best possible solutions for builders who wish to provide high quality lighting designs).

These procedures account for the characteristics of the room and the design and location of the specific high-efficacy luminaires that will be installed as the best method to determine if there is both sufficient and uniform light. A recognized lighting authority, the Illuminating Engineers Society (IES), provides guidelines for good lighting design in their Lighting Handbook, Reference & Application, 10th Edition.

IES guidelines recommend that at least 30 footcandles of light be provided for seeing tasks in kitchens. Visual tasks include, but are not limited to, the basic kitchen tasks that are described in the Energy Commission's *Residential Manual* as preparing meals and washing dishes. These tasks typically occur on accessible kitchen countertops, the tops of ranges and in sinks, where food preparation, recipe reading, cooking, cleaning and related meal preparation activities take place, as well as at the front of kitchen cabinets so that the contents of the cabinet are discernable.

To clearly demonstrate compliance with the *Standards* to a building department, the builder may provide a lighting layout design that includes a point-by-point illuminance grid for the high-efficacy lighting. To do this properly, this grid must account for the room geometry, fixture placement, coefficient of utilization (CU) of the fixtures, lamp lumens, lamp lumen depreciation, and reflectivity of all of the surfaces in the kitchen.

Uniform lighting assures that the minimum amount of light is available on all the work surfaces used in meal preparation and cleanup. Although the design should achieve 30 footcandles on most counter-height, horizontal work surfaces, there may be a few work-surfaces where the lighting levels fall below this value and the fronts of kitchen cabinets may also be below this value. Even in these locations, the lighting level provided by the high-efficacy source should not fall below the IES-recommended lower value for non-critical seeing tasks of 20 footcandles. Parts of counters that are not work surfaces, such as a corner underneath a cabinet, may have a lighting level below 20 footcandles and still meet the requirements of the standard, because meal preparation is unlikely to occur in those areas.

Manufacturers and lighting fixture representatives can often provide such a grid for a specified design. Electrical engineers who do lighting designs and professional lighting designers also often provide designs with a point-by-point illuminance grid.

The plans should identify the type of luminaire and maximum Underwriters Laboratory (UL)-rated lamp watts for each luminaire and should include dimensions and tolerances of each luminaire so that the installer, plan checker, and field inspector can all determine when the lighting installation matches the plan checker's judgment. When calculating the kitchen lighting wattage, the builder should be certain to use the maximum UL-rated wattage for each fixture.

2.7.2 Bathroom Lighting


§150(k)2 - 3

2. *Each room containing a shower or bathtub shall have at least one luminaire with lamp(s) with an efficacy of 40 lumens per watt or greater. If there is more than one luminaire in the room, the high efficacy luminaire shall be switched at an entrance to the room.*

   ALTERNATIVE to Section 150(k)2.: A high efficacy luminaire need not be installed in a bathroom if:

   A. *A luminaire with lamps with an efficacy of 40 lumens per watt or greater is installed in a utility room, laundry room, or garage; and*

B. All luminaires permanently mounted to the residence providing outdoor lighting shall be installed with the following characteristics:

(1) Luminaires with lamps with 40 lumens per watt or greater; or

(2) Luminaires with lamps with an efficacy of less than 40 lumens per watt shall be equipped with a motion sensor.

***Note:** When using this alternative for multiple bathrooms, after complying with B. for the first bathroom, each additional bathroom in which a high efficacy luminaire is not installed must comply with A. alone.*

3. Luminaires installed to meet the 40 lumens per watt requirements of Section 150(k) 1. or 2. shall not contain medium base incandescent lamp sockets, and shall be on separate switches from any incandescent lighting.

Each room with a shower or bathtub must have at least one luminaire with lamps with an efficacy of at least 40 lumens/watt. If there is more than one luminaire in the room, the high-efficacy luminaire must be switched at an entrance to the room.

As an alternative, both of the following are required:

1. A luminaire with 40 lumens/watt lamps must be installed in another room with utilitarian functions such as a laundry room, utility room or garage; and

2. All permanently mounted outside lighting must either be at least 40 lumens/watt or equipped with a motion sensor.

When using this alternative for two or more rooms with showers or bathtubs, compliance with item 1 (above) is sufficient for the second or third rooms since the outside lighting is already in compliance with item 2 above.

Luminaires installed to meet the 40 lumens/watt requirements cannot contain medium base incandescent lamp sockets, and must be on separate switches from incandescent lighting.

Incandescent lighting fixtures recessed into insulated ceilings must be approved for zero-clearance insulation cover (IC-rated) in compliance with §150(k)4 (see below).

Installing energy-efficient lamps and fixtures can reduce lighting energy costs without sacrificing the quality or quantity of light available. As indicated in Table 2-2, a 40 watt standard fluorescent lamp is over four times as efficient as a 100 watt standard incandescent lamp.

Incandescent lighting fixtures recessed into insulated ceilings must be IC-rated in compliance with §150(k)4 (see Example 2-9).

2.7.3 Recessed Lighting

§150(k)4

All incandescent lighting fixtures recessed into insulated ceilings shall be approved for zero-clearance insulation cover (I.C.) by Underwriters Laboratories or other testing/rating laboratories recognized by the International Conference of Building Officials.

All incandescent lighting fixtures recessed into insulated ceilings must be approved for zero-clearance insulation cover (IC-rated) in compliance with §150(k)4. Although this requirement does not apply to fluorescent fixtures, recessed lighting fixtures left un-insulated significantly increase the heat loss through the roof/ceiling area reducing the effectiveness of the insulation. Heat lamps are not required to be IC-rated.

Example 2-9 – Non-IC Rated Incandescent Fixtures

Question

I'd like to know if it is possible to use non-IC rated incandescent fixtures recessed in an insulated ceiling. Although I've never been able to find a bulb heater (heat lamp) that is IC- rated [approved for insulation cover], they are very popular with my customers. Can I use this product?

Answer

It is possible to build a box of gypsum board or other acceptable interior ceiling finishing material over the fixture so that it is below the boundary of the insulated ceiling. By separating the fixture from being recessed into the insulated ceiling it does not need an IC rating. As long as there is sufficient clearance between the fixture and the interior finishing material to prevent a fire hazard, this assembly is acceptable (recessed fluorescent fixtures do not need to be IC-rated). You can build a box like this to install a non-IC heat lamp or other non-IC rated fixtures.

Question

If insulation is installed between floors of an apartment building (sound-proofing), can I install incandescent fixtures that are not IC-rated?

Answer

No. Although this isn't part of the building envelope, *Standards* §150(k) states that any incandescent fixtures recessed into an insulated ceiling must be approved for zero-clearance insulation cover.

2.8 Compliance Documentation

The Mandatory Measures Checklist (see MF-1R form in Appendix A) is used to show compliance with mandatory measures at the documentation stage. The Installation Certificate and insulation Certificate (see the CF-6R and IC-1 forms in Appendix A) are used to demonstrate compliance at the construction phase. Both of these forms must be made available to the inspector during appropriate inspections, and copies must be provided to the original occupants of the building.

Mandatory Measures Checklist. A sample of the recommended Mandatory Measures Checklist (MF-1R) is included here. More information about the form is included in Chapter 1. Blank forms are contained in Appendix A.

Installation Certificate. A sample of the recommended Installation Certificate (CF-6R) is included here. More information about filling out the form or inspections tied to the form are included in Chapter 1. Blank forms are contained in Appendix A.

Insulation Certificate. A sample of the recommended Insulation Certificate (IC-1) is included here. More information about filling out the form or inspections tied to the form are included in Chapter 1. Blank forms are contained in Appendix A.